

Samira Malek

1416A Harris St. – State College, PA 16803 – USA

☎ +1 (415) 715 7956 • ✉ samiramalek30@gmail.com • 🌐 samiramalek.github.io
in samira-malek-733b9889 • 🏠 SamiraMalek • 🔑 3S6LVy4AAAAJ

Education

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| Pennsylvania State University <i>Ph.D. in Computer Science & Engineering</i> | Pennsylvania, USA 2023–present |
| Pennsylvania State University <i>M.S. in Computer Science & Engineering</i> | Pennsylvania, USA 2023–2025 |
| Sharif University of Technology <i>M.S. in Electrical Engineering</i> | Tehran, Iran 2018–2020 |
| Sharif University of Technology <i>B.S. in Electrical Engineering</i> | Tehran, Iran 2013–2018 |

Research Interests

- Natural Language Processing
- Computational Imaging
- Communication
- Computer Vision
- Learning Theory
- Information Theory
- Optimization
- Explainable Deep Learning
- Signal Processing

Honors and Awards

- Awarded the College of Engineering Dean's Office scholarship at **Pennsylvania State University**. 2022
- **Ranked 29th** in the Iran Nation-wide University Entrance Exam (Konkour) for M.S degree, among +40,000 test-takers. 2018
- **Ranked 40th** in the Iran Nation-wide University Entrance Exam (Konkour) for B.S degree, among +84,000 test-takers. 2013
- **Silver Medalist** of 30th Iran National Mathematical Olympiad. 2012
- Admission to high school in **National Organization for Development of Exceptional Talents (NODET)** (success rate < 0.3%). 2009

Research Experience

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| Pennsylvania State University <i>Ph.D. Thesis</i> | Pennsylvania, USA 2023–present |
| <ul style="list-style-type: none">◦ Designing generalizable and explainable deep neural networks for image restoration tasks such as denoising and deblurring.◦ Establishing theoretical guarantees of convergence for both the full network and its component blocks. | |
| Sharif University of Technology <i>M.S. Thesis</i> | Tehran, Iran 2018–2021 |
| <ul style="list-style-type: none">◦ Designed novel neural network decoders (MVN, MatNet) inspired by belief propagation.◦ Improved decoding accuracy (lower BER) on BCH, LDPC, and Polar codes.◦ Reduced computational complexity by up to 98% compared to prior state-of-the-art methods. | |
| Sharif University of Technology <i>B.S. Thesis</i> | Tehran, Iran 2016–2017 |
| <ul style="list-style-type: none">◦ Analyzed recorded MicroElectroRetinoGram (MERG) signals from mice to study neural retina responses.◦ Developed denoising and classification methods to differentiate healthy and unhealthy retinas. | |

Work Experience

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| Applied Research Laboratory, Pennsylvania State University <i>Research Assistant</i> | Pennsylvania, USA 2024–2025 |
| <ul style="list-style-type: none">◦ Developed a methodology powered by Large Language Models (LLMs) to detect health-related misinformation (both human-created and AI-generated) on social media.◦ Designed a hierarchical topic modeling framework to analyze misinformation and generate sentence-level topic descriptions.◦ Built a refutation generation module to explain inaccuracies and provide corrective responses with actionable guidance.◦ Applied the framework to datasets of COVID-19 and HPV vaccine misinformation, producing interpretable analyses. | |

SNOWA

Data Scientist

Tehran, Iran

2022

Contributed as a Data Scientist in the Customer Relationship Management (CRM) department of SNOWA, a leading home appliance manufacturer in Iran. Key projects included:

- Developed customer segmentation using unsupervised learning (e.g., K-means) to support targeted marketing.
- Applied graph-based algorithms in SQL to identify and analyze customer relationship networks.
- Designed and developed a scalable Data Warehouse to support business intelligence and analytics.

Grants & Funding

- Financial assistance award from the Economic Development Administration Build Back Better Regional Challenge, Farms Food Future (F3) Innovation.
- Partial support from NSF and AgAID Institute (Agricultural AI for Transforming Workforce and Decision Support) under the USDA-NIFA award No. 2021-67021-35344.
- Research grant from the Investigator Initiated Studies Program of Merck Sharp & Dohme Corp (MISP #102050).

Publications

- Hamed Mahdavi, Alireza Hashemi, Majid Daliri, Pegah Mohammadipour, Alireza Farhadi, **Samira Malek**, et al. "**Brains vs. bytes: Evaluating llm proficiency in Olympiad mathematics**", Conference On Language Modeling, 2025.
- **Samira Malek**, et al. "**A Methodology Framework for Analyzing Health Misinformation to Develop Inoculation Intervention Using Large Language Models: A case study on covid-19**", submitted to Journal of Medical Internet Research, 2025.
- **Samira Malek**, et al. "**A Large Language Model-Based Analyzing of HPV and COVID-19 Vaccines Misinformation on Social Media**", submitted to Health Informatics Journal, 2025.
- **Samira Malek**, et al. "**Cascaded, Convergent Unrolled Deep Neural Networks for Blind Image Deconvolution**", submitted to IEEE Transactions on Computational Imaging, 2025.
- Mohsen Farajijalal, **Samira Malek**, et al., "**Data-Driven Model to Improve Mechanical Harvesters for Nut Trees**", ASABE Annual International Meeting, 2024.
- **Samira Malek**, et al., "**Multi Variable-layer Neural Networks for Decoding Linear Codes**", Iran Workshop on Communication and Information Theory (IWCIT), IEEE, 2020.
- **Samira Malek**, et al., "**A Deep Neural Network Architecture for Decoding Linear Codes Based on the Parity Check Matrix**", (it's available [here](#)).

Teaching Experience

- **TA for Discrete Mathematics** in Pennsylvania State University. *Spring & Fall 2023, Spring 2024*
- **TA for Signal & System** in Sharif University of Technology. *Fall 2019*
- **TA for Stochastic Random Process** in Sharif University of Technology. *Spring 2019*
- **TA & MATLAB Teaching for Engineering Mathematics** in Sharif University of Technology. *Spring 2019*
- **Design Mock Test** of the Iran Nation-wide University Entrance Exam (Konkour) for B.S degree in [Kanoon Institution](#), which has the most participants in Iran (more than +20,000 students every year). *2017–2018*
- **Teaching Mathematics** Farzanegan High school (NODET), Preparing students for Iran National Mathematical Olympiad. *2014–2015*

Selected Courses

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|------------------------------|--------------------------------|---------------------------------|
| ○ Deep Learning for NLP | ○ Large Scale Machine Learning | ○ Machine Learning Algs & Tools |
| ○ Convex Optimization | ○ Non-convex Optimization | ○ Distributed Optimization |
| ○ Pattern Recognition & ML | ○ Secure & Robust ML | ○ AI and Biological Computation |
| ○ Probability and Statistics | ○ Stochastic Random Process | ○ Speech Processing |
| ○ Communication Systems | ○ Digital Signal Processing | ○ Image Processing |

Selected Academic Projects

Deep Learning

Fallacy Science Question Answering with LLMs

Fall 2024

- Built dataset of fallacy-based science questions; evaluated Llama, Gemini, and ChatGPT, improving model accuracy on reasoning by 60% through optimized prompts.

Identifying the Source Model of Generated Text

Fall 2024

- Generated datasets using five large language models and trained BERT classifiers to distinguish text by source model.

Multi-hop Question Answering with GPT

Spring 2023

- Trained GPT models via prompting for multi-hop reasoning on the HotPotQA benchmark.

Pitch Tracking in Noisy Speech

Spring 2019

- Implemented feedforward and recurrent neural networks for pitch estimation in noisy conditions.

EEG-based Typing Classification

Spring 2016

- Designed a neural network to classify right- vs. left-handed typing using EEG signals.

Backdoor Attack and Detection on CIFAR-10

Spring 2024

- Designed and evaluated additive backdoor attacks and implemented detection methods for image classifiers.

Optimization.....

MinMax Optimization Algorithms

Spring 2023

- Implemented Stochastic Gradient Descent Ascent (SGDA) and Stochastic Compositional Gradient (SCSC) for min-max optimization problems.

Classical Optimization Methods

Fall 2018

- Implemented BFGS, Steepest Descent, and Newton's method with line-search for nonlinear optimization.

Signal Processing & Communications.....

Viterbi Algorithm and Sequence Detection

Spring 2020

- Implemented the Viterbi algorithm and developed a reduced-complexity sequence detector for communication systems.

Pitch Contour Extraction

Spring 2019

- Extracted pitch contours from speech signals using SIFT, HPS, and AMDF algorithms.

Image Recovery via Sparse Methods

Fall 2018

- Applied IMAT and OMP algorithms for image recovery from incomplete data.

Signal Reconstruction Techniques

Fall 2018

- Reconstructed 1-D and 2-D signals using SDFT and RS methods.

Computer Skills

Programming Languages: Python, MATLAB, SQL, C/C++, L^AT_EX, html

Software: VScode, Anaconda, Microsoft Power BI, Microsoft SQL Server Management Studio

Languages

- English
- Persian
- Azerbaijani